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Vol. 7, Nos. 7, 8

九州帝國大學農學部紀要

JOURNAL
OF THE
DEPARTMENT OF AGRICULTURE
KYŪSYŪ IMPERIAL UNIVERSITY

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Report on the Ophiurans from off Ogasawara Islands
and from off the Yaeyama Group, Nippon

Note on the Ophiurans of Amakusa, Kyūsyū



九州帝國大學農學部發行

昭和十九年六月十五日

HUKUOKA (Fukuoka), NIPPON

June 15, 2604 (1944)



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REPORT ON THE OPHIURANS FROM OFF OGASAWARA ISLANDS AND FROM OFF THE YAÉYAMA GROUP, NIPPON¹⁾

Shiro MURAKAMI

In 1943, in his investigations on the Ophiurans of the coral reefs of Isigaki-sima, Yaéyama, the author could recognize that the majority of them were referable to tropical elements. The Ophiurans of Ogasawara (Bonin) Islands, which have hitherto been dealt with very insufficiently, represented by only two littoral forms, namely, *Ophiarachna incrassata* (LAMARCK) and *Ophiocoma scolopendrina* (LAMARCK) (MATSUMOTO, 1917), are also derivatives from tropical forms. I hoped to carry out further a research on the sublittoral faunae of these districts. The late Dr. Hayato IKEDA of the Fisheries Institute of Kyūsyū Imperial University made a good collection of Ophiurans on board of a coral-fishing boat off Ogasawara Islands and off the Yaéyama Group during his expeditions in 1940, and kindly placed them at my disposal for study. In addition to these, a number of Ophiuran specimens, probably obtained by him at one of the above mentioned localities, have been preserved, without label, at the Zoological Laboratory of the said University, and it seems to be suitable to treat them together in the present paper. In view of the fact that very little work has ever been done on the sublittoral Ophiurans of these districts, it must be of great interest to study such a valuable material, most of which belong to the forms rare and difficult to obtain. A close examination of them has revealed that the collection consists of twenty-two species, as will be described here in the

¹⁾ Contributions from the Zoological Laboratory, Kyūsyū Imperial University, No. 168; Papers from the Amakusa Marine Biological Laboratory, No. 90.

following pages. The following species are contained in the collection, and among them eight are deemed to be new to science:

Order Phrynophiurida

Family Ophiomyxidae

1. *Ophiomyxa australis* LÜTKEN
2. *Ophiobyrsa strictima* sp. nov.
3. *Ophiobrachion hamispinum* sp. nov.

Family Trichasteridae

4. *Astroceras calix* sp. nov.
5. *Astroceras coniunctum* sp. nov.
6. *Astroceras paucispinum* sp. nov.

Family Asteroschematidae

7. *Astroschema yaeyamensis* sp. nov.

Family Gorgonocephalidae

8. *Asteroporpa hadracantha* CLARK
9. *Astrodendrum sagaminum* (DÖDERLEIN)
10. *Astrocladus coniferus* (DÖDERLEIN)
11. *Astroglymma sculptum* (DÖDERLEIN)
12. *Astrothamnus bellator* (KÖHLER)
13. *Astroclon propugnatoris* LYMAN

Order Laemophiurida

Family Ophiacanthidae

14. *Ophiomitrella ikedai* sp. nov.
15. *Ophiacantha bisquamata* MATSUMOTO
16. *Ophiacantha pentagona* KÖHLER
17. *Ophiocamax rugosa* KÖHLER

Family Hemieuryalidae

18. *Ophiomæris pentagona* sp. nov.

Order Gnathophiurida

Family Ophiotrichidae

19. *Ophiothrix vetusta* KÖHLER

Order Chilophiurida

Family Ophielepididae

20. *Ophiomusium simplex* LYMAN

Family Ophiodermatidae

21. *Pectinura aequalis* (LYMAN)

Family Ophiochitonidae

22. *Ophioplax lamellosa* MATSUMOTO

Among these, *Ophiacantha pentagona* is an intertropical species, which is widely distributed in both the Indo-Pacific and Atlantic, but not in the Arctic or Antarctic. *O. australis*, *A. sagaminum*, *A. coniferus*, *A. sculptum*, *A. propugnatoris*, *O. bisquamata*, *O. rugosa* and *O. simplex* are Indo-Pacific in distribution, ranging from the Indian Ocean or Malaysian Waters to Nippon. *A. bellator*, *O. vetusta* and *P. aequalis* have been reported from the Malaysian Waters to Philippines, but not from Nippon. *A. hadracantha* and *O. lamellosa* have been recorded only from vicinities of Honsyū, and were regarded as representatives of the Honsyū species. Accordingly the greater part of sublittoral forms of the regions in question may also be regarded to represent tropical elements.

Here I must express my hearty thanks to Professor Dr. H. OHSHIMA for giving me kind guidance and suggestion during my study. Further, I wish also to thank the late Dr. H. IKEDA for the privilege which he gave me to undertake the work. The photographs are from the hands of Mr. T. KAWAHARA of the Zoological Laboratory, Kyūsyū Imperial University.

SYSTEMATICS

Family Ophiomyxidae

1. *Ophiomyxa australis* LÜTKEN

LÜTKEN, 1869, p. 45 & 99. CLARK, 1915, p. 168, pl. I, figs. 1-2. MATSUMOTO, 1917, p. 19, fig. 3, pl. I, figs. 4-7.

Localities.—Off Ogasawara, 1940; two specimens. Off Yaéyama, 1940; seven specimens.

Distribution.—Sagami Sea. Tyōsen Strait. Eastern Sea. Mauritius. Sulu Sea. Amboina. Caroline Islands. Southern Australia. Bass Strait. New Zealand. Fiji Islands. Tongatabu Is.

The specimens before me range from 8 to 18 mm across the disk. The oral papillae, free margin of which is neither strongly serrated nor transparent, are five in number on a side of an oral angle, among which distal two are rudimentary. The colour of dried specimens is brown on the disk and gray on the arms, the disk being not spotted with darker shades as it is said to be in MATSUMOTO's specimens.

2. *Ophiobyrsa strictima* sp. nov.¹⁾

(Text-figs. 1-2)

Disk 23 mm in diameter; arms broken, but more than 190 mm long in intact state; breadth of arm 3.5 mm at base.

Disk pentagonal, covered with a thick skin carrying numerous small compact scales, majority of which bear single spinelet.

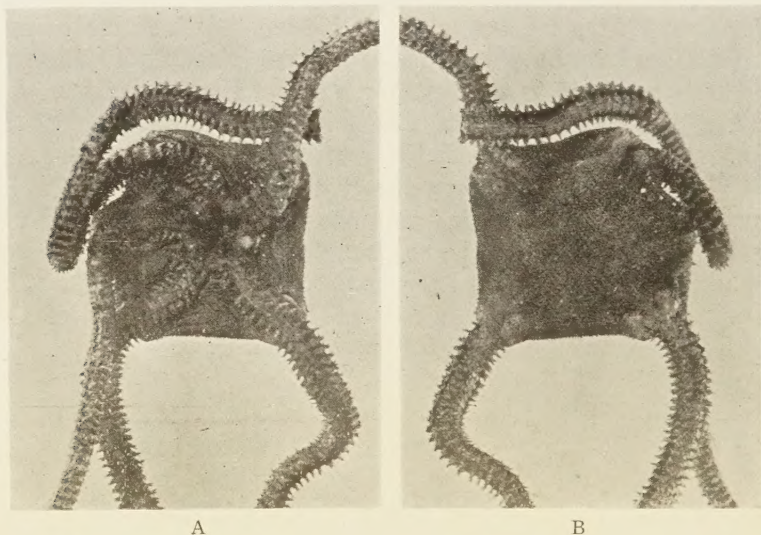


Fig. 1. *Ophiobyrsa strictima*.

A. From below. B. From above.
Slightly enlarged.

Radial shields faintly indicated, small, broadly separated from each other, furnished with spinelets on the surface. Interbrachial spaces below also covered with similar covering to that of the dorsal side of disk. Genital slits large, reaching from the oral shield to the periphery of disk.

Oral shields small, oval, somewhat longer than broad. Adoral shields also of small size, triangular, longer than broad, slightly curved so as to embrace the oral shield, but not in contact with each other within. Oral plates stout. Oral papilla single, or sometimes absent, small, spiniform. Dental papillae numerous, arranged

¹⁾ *Strictim*, signifying *closely*, in reference to the disk closely covered with numerous small scales.

in three more or less irregular vertical rows, terminating in two or three spinelets at the end.

Arms slender, uniformly tapering. Dorsal arm plates broken into fragments, each of which bears small, conical granules, but lateral ones are occasionally free from such granules. First ventral arm plates rather small, tetragonal, broader without than within. Following ones at first also tetragonal, with a distal border notched at the middle, broader than long, but becoming trapezoid distally, with lateral sides concave and diverging outwards. They are in contact with each other throughout the whole length of arm. Side arm plates narrow, broadly separated from each other both above and below. Arm spines seven in number near the disk, but reduced to five distally, less than a joint in length, flat, furnished with thorns along the margin; the lowest one is hook-shaped, having two to six branches along the proximal side, which increase in length towards the extremity. No tentacle scales.



Fig. 2. Arm spines of *Ophiobryssa strictima*.
A. Undermost one.
B. Upper one. $\times 28$.

Colour (dried from alcohol), brown.

One specimen; locality unknown.

The new species is closely related to *O. acanthinobrachia* CLARK in carrying a number of spinelets on the dorsal side of arm, but is easily distinguished from it by the compact disk scaling, by the oval oral and narrow adoral shields, and by the dental papillae arranged in three more or less irregular rows.

3. *Ophiobranchion hamispinum* sp. nov.¹⁾

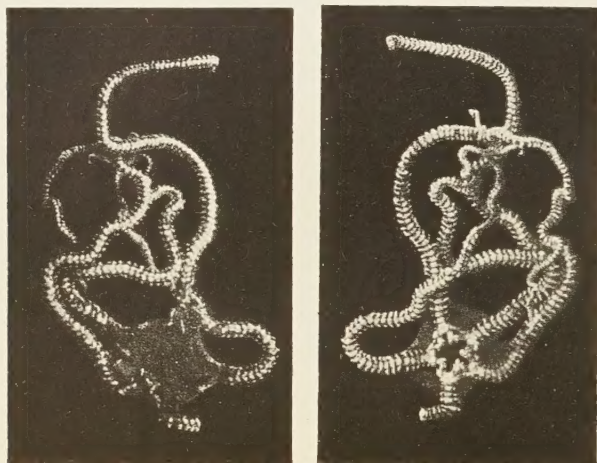
(Text-figs. 3-4)

Disk 14 mm in diameter; arms 80 mm long. Breadth of arm about 2 mm at base. Disk flat, pentagonal, slightly concave at the interradial border, covered with a thick skin containing many small, rounded, more or less scattered scales, each of which bears a conical spinelet. Radial shields small, about one-third of disk radius in length, elongate, three times as long as broad, slightly enlarged distally, carrying a number of coarse granules or spinelets

¹⁾ *Hamus*, signifying hook, and *spina*, signifying spine, in reference to the hook-shaped arm spines.

at the proximal part. Interbrachial spaces below are like that of the dorsal side of disk. Genital slits large.

Mouth parts and arms also covered with a thick skin. Oral shields very small, somewhat triangular, with angles rounded, broader than long. Adoral shields large, oblong, about two times



A
Fig. 3. *Ophiobranchion hamispinum*.
B

A. From above. B. From below.
About natural size.

as long as broad, with proximal and distal ends rounded, longer borders nearly parallel; they are not meeting within and separate the first side arm plate from the oral shield distally. Oral plates very conspicuous, higher than broad. Oral papillae one or two on a side, sharply pointed; distal one larger than the proximal one. Dental papillae numerous, crowded at the tip of jaw, long and acute, distal half of which is transparent.

Arms slender, slowly tapering. Dorsal arm plates small, rudimentary, broken into two pieces laterally by longitudinal interval, each of which is elliptical and longer than broad. First ventral arm plates very large, as large as, or somewhat larger than, the following ones, much broader than long, proximal margin rounded, distal one somewhat trilobed. Second one pentagonal, with a very wide proximal angle, much broader than long. Following several plates truncated at the proximal angle so as to become hexagonal

in shape, also broader than long, the distal border much longer than the proximal one; but distally they become tetragonal and as long as broad. First two or three ventral arm plates are in contact with each other, but soon becoming separated from each other distally by a narrow interval. Side arm plates not meeting both above and below, bearing five conspicuous mamelons along the distal ridge, each of which supports an arm spine. Arm spines five in number, transparent, hook-shaped, strongly curved inwardly at the terminal part, carrying two or three branches along the proximal side, which increase in length as it proceeds distally. Tentacle pores inconspicuous, without scales.



Fig. 4. Arm spine of *Ophiobranchion hamispinum*. $\times 28$.

Colour (dried from alcohol), brown.

Locality.—Off Yaéyama, 1940; three specimens.

As only a single Ophiuran, *O. uncinatus*, described by LYMAN has been known in the present genus, it is my great joy to find such a rare form in the collection. The number and shape of arm spines well serve to distinguish *O. hamispinum* from *O. uncinatus*. The specimens at hand range from 7 to 16 mm in the diameter of disk, showing a little variation in their characters.

Family Trichasteridae

4. *Astroceras calix* sp. nov.¹⁾

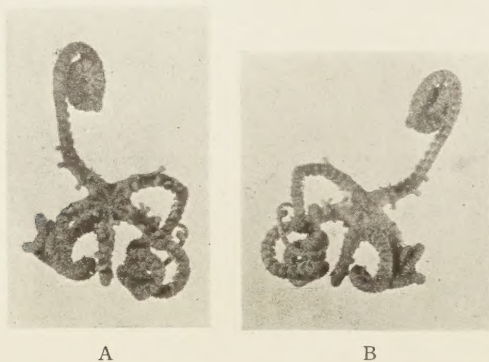
(Text-figs. 5-6)

Disk 5 mm in diameter; arms about 40 mm long. Breadth of arm 2 mm at base.

Disk five-lobed, concave at the interradiar border, thick and flat, covered with a thick skin containing a number of thin scales. Radial shields very large, nearly reaching the centre of disk, where they are flattened and are in contact with each other, somewhat narrow and swollen at the distal part, furnished with coarse granules on the surface; at the distal end of each radial shield is a conspicuous cup-shaped spine, which is exceedingly enlarged and thorny at the tip. Genital slits small, nearly vertical.

¹⁾ *Calix*, signifying *cup*, in reference to the conspicuous cup-shaped spines of radial shield and proximal part of arm.

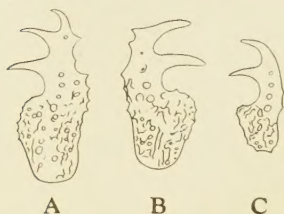
The mouth parts are faintly indicated by the skin. Oral shields small, triangular. Adoral shields large, trapezoid, broader within than without, fully in contact with each other at the interradi- al



A B
Fig. 5. *Astroceras calix*.
A. From above. B. From below.
Slightly enlarged.

area. Teeth about six in number on a jaw, thick and stout, triangular in shape, with a rounded proximal angle, broader than long; the one ventrally situated is a little the smallest. Oral papillae wanting, but papilla-like granules present along the oral slit.

Arms flat and naked on the dorsal side at base, but becoming rounded and remarkably granulated distally. Lateral bars con-



A B C
Fig. 6. Transformed spines (A-B) and hook spine (C) of *Astroceras calix*. $\times 80$.

spicuous at the proximal four or five joints, and well separated from each other above, each of which bears one or rarely two conspicuous spines at the upper end similar to those of the radial shield. Ventral arm plates small, tetragonal. Side arm plates small, reduced to a spine-bearing shaft, broadly separated from each other. Arm spines two in number to each side arm plate, blunt and thorny at the tip. First tentacle pores without spines. Hook spines have no regular series of holes in the lamina.

Colour (dried from alcohol), brown.

Locality.—Off Yaéyama, 1940; two specimens.

Astroceras calix is obviously allied to *A. pergamena* LYMAN and *A. pergamena* var. *granulatum* MORTENSEN, but the conspicuous cup-shaped spines borne on the radial shields and on the dorsal side of arm at base are a distinct character to keep it separate from the latter species. Further, the granulation of arms and radial shields, in combination with the larger radial shields, forms another feature to characterize the new species.

5. *Astroceras coniunctum* sp. nov.¹⁾

(Text-figs. 7-8)

Disk 9 mm in diameter; arms more than 70 mm long. Breadth of arm 2 mm at base.

Disk and arms covered with a thick skin carrying small, delicate scales. Disk thick, five-lobed, slightly notched at the interradial border. Radial shields very large, much longer than broad, in contact with each other at the centre of disk, each one of which is provided with a linear series of three or four rounded, thorny spines on the surface. Genital slits small, oblique.

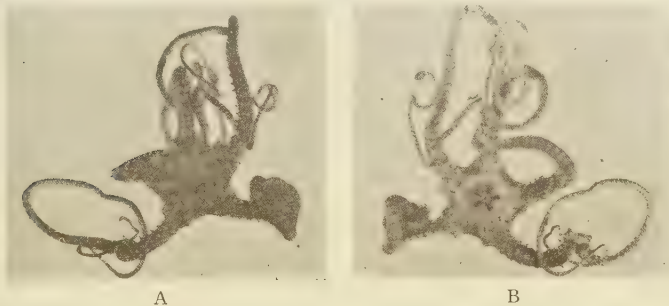


Fig. 7. *Astroceras coniunctum*.

A. From above. B. From below.
Slightly enlarged.

Oral shields indistinct. Adoral shields large, situated almost horizontally, broader within than without, fully in contact with each other on the interradial line. Teeth stout, flat, longer than broad, somewhat triangular in shape, blunt at the proximal end;

¹⁾ *Coniunctus*, signifying *adjoining*, in reference to the spines, which are borne on the dorsal side of arm at base, approaching each other.

the undermost one is the smallest and narrow. Oral papillae absent.

Arms rather slender, somewhat higher than broad at base. Lateral bars present at base of arm, small, in contact with each other on the dorsal side of arm; at the upper end of each lateral bar is a distinct, rounded, thorny spine, which stands side by side with a fellow of the opposite one. It is reduced in size as it goes distally, finally disappearing from the seventh or eighth joint. Ventral arm plates indistinct. Side arm plates small, broadly separated. Arm spines two in number, somewhat elongate, rough at the end. First tentacle pores unprotected. Hook spines are of the typical form and show the regular series of holes in the lamina.



Fig. 8. Hook spine of
Astroceras coniunctum.
×80.

Colour (dried from alcohol), deep brown above, but much lighter on the ventral side.

Locality.—Off Ogasawara, 1940; one specimen.

Only a single specimen is before me, but its characters are remarkable enough to make it a distinct species. It is another member closely related to *A. pergamena* LYMAN, but is easily distinguished from it by the fact that the lateral bars are in contact with each other on the dorsal side of arm, and the radial shield is furnished with a linear series of three or four spines on the surface.

6. *Astroceras paucispinum* sp. nov.¹⁾

(Text-figs. 9-10)

Disk 5 mm in diameter; arms all broken off at different distances from the disk, but the longest available being about 24 mm long. Breadth of arm 2 mm at base.

Disk flat, five-lobed, concave at the interradial border, covered with a thin integument containing a small number of thin scales. Radial shields small, about three-fifths of disk radius in length, less than three times as long as broad, separated from each other, rather irregular in shape, some ones of which are somewhat fusi-

¹⁾ *Pauci*, signifying *few*, and *spina*, signifying *spine*, in reference to a small number of spines borne on the dorsal side of arm at base.

form, while the others are divided into two lobes at the proximal end; in the specimen at hand they are not furnished with spines or granules on the surface, but in life, some of them must have carried some such, for they show an articular process on the surface. Genital slits small, vertical.

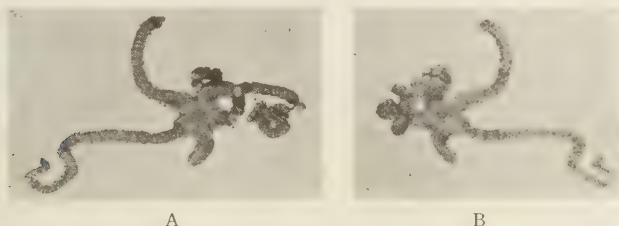


Fig. 9. *Astroceras paucispinum*.

A. From above. B. From below.
Slightly enlarged.

Oral shields indistinct. Adoral shields large, enlarged and rounded at the distal part, narrow within, fully in contact with each other at the interradial area. Oral plates higher than broad. Teeth distinct, somewhat triangular in shape, with a rounded free margin, nearly as broad as long.

The dorsal side of arm flat at base, but becoming rounded and distinctly granulated distally. Lateral bars inconspicuous even at the base of arm, only a small number of which carry a small, rounded, rough spine at the upper end. Ventral arm plates small, quadrangular, broader than long. Side arm plates broadly separated from each other, reduced to a spine-bearing shaft. Arm spines two in number, small, some of which are blunt at the tip, while the others are tapering to a point. First tentacle pores without such spines. Hook spines show no regular series of holes in the lamina.

Colour (dried from alcohol), yellowish white.

Locality.—Off Ogasawara, 1940; one specimen.

The present specimen is not in good state of preservation, but as the features are very characteristic, it seems to be best to let it stand as a new species. This species somewhat resembles *A.*



Fig. 10. Hook spine of *Astroceras paucispinum*. $\times 80$.

mammosum KÖHLER, but the peculiar shape of radial shields, combined with the presence of granules on the dorsal side of arm, makes it separate from *A. mammosum*.

Family Asteroschematidae

7. *Asteroschema yaéyamensis* sp. nov.

(Text-fig. 11)

Disk 7 mm in diameter; arms cannot be accurately measured owing to their convolution, but roughly 150 mm long; the swollen basal part of arm 5 mm in breadth and 3 mm in height, but beyond it becoming 2.5 mm wide and 2 mm high.

Disk flat, about as high as the base of arm, pentagonal, distinctly notched at the interradial border, covered with numerous compact, coarse, conical granules. Radial ribs small, about one half of radius in length, twice as long as broad, slightly enlarged distally, also provided with conical granules, separated from each other by a groove. Interbranchial spaces below and the mouth parts also covered with rather rounded granules; those of the latter are somewhat coarser than the rest. Genital slits small, nearly vertical.

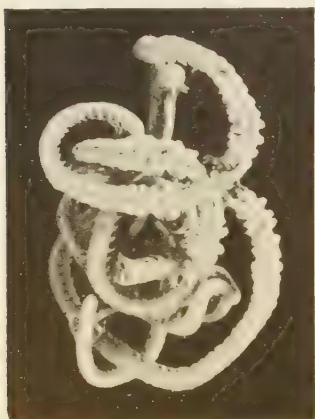


Fig. 11. *Asteroschema yaéyamensis*; from above. Slightly enlarged.

Oral shields invisible. Adoral shields more or less bare in the preserved specimen, large, oblong, more than twice as long as broad, broadly in contact with each other on the interradial line. On each side of jaw are several distinct granules, corresponding to oral papillae. Teeth ten in number, large, stout, flat, rounded triangular in shape. Infradental papillae two in number, lying side by side, each of which is about one half of the following tooth in size, and triangular or rhomboidal in shape.

Arms also covered with rather regularly spaced, conical granules, swollen and ribbed laterally at the first seven or eight joints; beyond them becoming rounded, even, and slowly tapering. A

shallow groove runs longitudinally along the dorsal side of arm at base. Arm spines long, cylindrical, rough at the tip. First tentacle pores without such spines; next one or four with one, and the rest with two spines; the inner one larger than the abradial one.

Colour (dried from alcohol), dirty gray.

Locality.—Off Yaéyama, 1940; one specimen.

The new species is very near to *A. tumidum* LYMAN, but is easily distinguished from it by smaller radial ribs, and by more numerous and more conspicuous arm ribs.

Family Gorgonocephalidae

8. *Asteroporpa hadracantha* CLARK

CLARK, 1911, p. 280, fig. 142.—1915, p. 182. MATSUMOTO, 1917, p. 67, fig. 17.

Localities.—Off Ogasawara, 1940; one specimen. Off Yaéyama, 1940; one specimen. Five specimens; locality unknown.

Distribution.—Sagami Sea. Off Omae Zaki Light. Ensyū Sea. Ōsumi. Eastern Sea.

9. *Astrodrum sagaminum* (DÖDERLEIN)

Gorgonocephalus sagaminus: DÖDERLEIN, 1902, p. 321.

Astrodrum sagaminum: DÖDERLEIN, 1911, p. 38, pl. II, figs. 3–5, pl. VII, fig. 8. CLARK, 1915, p. 185. MATSUMOTO, 1917, p. 73, fig. 21.

One specimen; locality unknown.

Distribution.—Sagami Sea. Ōse Zaki, Suruga Gulf. Eastern Sea. Sea of Nippon. Indian Ocean.

10. *Astrocladus coniferus* (DÖDERLEIN)

Astrophyton pardalis: DÖDERLEIN, 1902, p. 323.

Astrophyton coniferum: DÖDERLEIN, ditto, p. 325.

Astrocladus dofleini: DÖDERLEIN, 1910, p. 256.¹⁾

Astrocladus coniferus: DÖDERLEIN, 1911, p. 46 & 75, pl. II, figs. 7–7a, pl. IV, figs. 1–3a, pl. VII, figs. 5–6a & 16. CLARK, 1915, p. 186. MATSUMOTO, 1917, p. 77, fig. 23.

Localities.—Off Ogasawara, 1940; one specimen. Off Yaéyama, 1940; one specimen. Four specimens; locality unknown.

Distribution.—Misaki. Sagami Sea. Suruga Gulf. Off Omae Zaki Light. Ensyū Sea. Kagosima. Colnett Strait. Eastern Sea. Tyōsen Strait. Fusan. Wladiwostok. Indian Ocean.

¹⁾ "Schultze-Zool. Ergebn., IV", not accessible to me.

The specimens before me measure from 12 to 50 mm across the disk. They are beset with many hemispherical tubercles on the dorsal side of disk and arms. Each radial rib carries a very conspicuous tubercle at the distal end. The ground colour of three specimens is dirty white, variegated with brownish purple, while the others are purplish black or gray.

11. *Astroglymma sculptum* (DÖDERLEIN)

Astrophyton sculptum: DÖDERLEIN, 1896, p. 299, pl. XVIII, fig. 29.

Astrodactylus sculptus: DÖDERLEIN, 1911, p. 56, fig. 13, a-b.

Astroglymma sculptum: DÖDERLEIN, 1927, p. 47 & 96, pl. I, figs. 3-4, pl. V, fig. 13.¹⁾
MORTENSEN, 1934, p. 5, pl. VI.

Three specimens; locality unknown.

Distribution.—Hong Kong. Amboina. Kei Islands.

12. *Astrothamnus bellator* (KÖHLER)

Astrotoma bellator: KÖHLER, 1904, p. 154, pl. XIX, fig. 8, pl. XXIII, fig. 1, pl. XXVIII, figs. 8-9.

Astrothamnus bellator: MATSUMOTO, 1915, p. 60.

Locality.—Off Yaéyama, 1940; one specimen.

Distribution.—Off Sulu Archipelago.

The specimen at hand is about 10 mm in the disk diameter. The arm spines are six in number at three basal arm joints and then fall to five distally; in the type they are five from the first proximal. The other features show no distinct diversity from the type.

13. *Astroclon propugnatoris* LYMAN

LYMAN, 1879, p. 69, pl. XVIII, figs. 481-486. MORTENSEN, 1933, p. 33, fig. 25, pl. II, fig. 3.

Three specimens; locality unknown.

Distribution.—Off Gotō Islands. Off Kei Islands.

Our specimens measure from 24 to 52 mm in the diameter of disk, but the arms are broken into fragments. Besides to mention that the features agree well with the type described by LYMAN, it is unnecessary to add any further account.

¹⁾ "Abh. Bayer. Akad. Wiss., XXXI, 6", not accessible to me.

Family Ophiacanthidae

14. *Ophiomitrella ikedai* sp. nov.

(Text-fig. 12)

Disk 5.5 mm in diameter; arms torn away, but probably more than five times as long as the disk diameter in the intact state.

Disk rounded or somewhat decagonal, slightly notched at the interradial border, covered with a coating of many small, delicate scales, bearing a number of rather coarse, rough, rounded, scattered granules. Radial shields bare, rather of small size, less than one half of disk radius in length, triangular, somewhat longer than broad, separated from each other. Interbranchial spaces below very



Fig. 12. *Ophiomitrella ikedai*.

A. From above.

B. From below.

C. Arm spines of one side of an arm joint near disk. $\times 11$.

narrow, covered with a number of small, thin, imbricating scales, which are free from granules. Genital slits conspicuous.

Oral shields moderate, rhomboidal, much broader than long, with a distal angle rounded. Adoral shields large, trapezoid, broader within than without, about two times as long as broad, fully in contact with each other on the interradial line. Oral plates distinct, higher than broad. Oral papillae three or four on a side of an oral angle; the proximal one is elongate conical, while the distal ones are flat and enlarged at the end. Teeth somewhat triangular in shape, longer than broad, flat, blunt at the tip, but the one ventrally situated is conical.

Arms rather stout. Dorsal arm plates small, triangular, with a sharp proximal angle and a convex distal margin, broader than long, completely separated from each other by the side arm plate. First ventral arm plates small, somewhat hexagonal, broader than long. Following ones rhomboidal, with a distal angle rounded, much wider than long. Some proximal ventral arm plates are scarcely in contact, but beyond them becoming separated from each other as it approaches the tip. Side arm plates well developed, very prominent, meeting both above and below. Arm spines ten in number near the disk, falling to five distally, long and crowded, finely thorny on the surface; the uppermost one or the next is the largest, and about four times as long as an arm joint; the rest are reduced in length downwards, towards the undermost one which is the smallest, being about as long as a joint. Those of each side of the basal joints are continuous on the dorsal midline. Tentacle scales single for each pore, elongate; those of proximal two or three joints are spatulate, but becoming bluntly pointed as it proceeds distally.

Colour (dried from alcohol), grayish white.

Locality.—Off Yaéyama, 1940; ten specimens.

The specimens at hand range from 3.5 to 5.5 mm in the disk diameter. *O. ikedai* is nearly allied to *O. mutata* K  HLER, *O. sagittata* K  HLER and *O. subjecta* K  HLER, but is easily distinguished from them by the spherical granules of disk, and by the rhomboidal oral and trapezoid adoral shields. The new species is dedicated in memory of the lamentable death of Dr. H IKEDA, a talented echinologist of our country.

15. *Ophiacantha bisquamata* MATSUMOTO

Ophiacantha bisquamata: MATSUMOTO, 1915, p. 62.—1917, p. 120, fig. 31.

Ophiotreta bisquamata: KÆHLER, 1930, p. 64.

Locality.—Off Yaéyama, 1940; six specimens.

Distribution.—Sagami Sea. Kei Islands.

The largest specimen before me is about 7.5 mm across the disk, but its arms are torn away at different distances from the disk. The larger ones are somewhat different from the type. The arm spines are more than those of the latter in number, being seven or eight near the disk, and the ventral arm plates are wider than long at least near the disk, while they are as long as wide in the type. But such differences seem to me to be hardly of specific value, being most probably due to the advanced age of the animals. The smaller ones agree well with the type even in minor features.

16. *Ophiacantha pentagona* KÆHLER

KÆHLER, 1897, p. 342, pl. VIII, figs. 56-57. CLARK, 1915, p. 204. MATSUMOTO, 1917, p. 116.

Locality.—Off Yaéyama, 1940; five specimens.

Distribution.—Uraga Channel. Sagami Sea. Suruga Gulf. Off Ōsima. Ensyū Sea. Kumano Sea. Tyōsen Strait. Southwest of the Gotō Islands. Eastern Sea. Malaysian Waters. West of Africa.

The present species is one of the common Ophiurans found in the Nipponese waters. I was also able to find it in the Sagami Sea and Suruga Gulf during my stay at the Mitsui Institute of Marine Biology.

17. *Ophiocamax rugosa* KÆHLER

Ophiocamax rugosa: KÆHLER, 1904, p. 139, pl. XXVI, figs. 4-7. CLARK, 1915, p. 214.

KÆHLER, 1922, p. 147, pl. XXVII, figs. 5-8, pl. XXVIII, figs. 1-6, pl. XXIX, figs. 1-6, pl. XCIV, fig. 8.

Ophiocamax polyploca: CLARK, 1911, p. 193, fig. 90.—1915, p. 214.

Locality.—Off Yaéyama, 1940; three specimens.

Distribution.—Eastern Sea. Off Kagosima Gulf. Philippine Islands. Off Zamboanga. Off southwest end of Timor. Kei Islands.

KÆHLER, who studied a vast number of specimens of this species collected by "Albatross" and found much variation among

them, united CLARK's *O. polyploca* with the present species. A close examination of the specimens at hand has convinced me that they shall also be contained in the same category without fail. The largest specimen measures about 8 mm across the disk. The disk is rounded, slightly concave at the interr radial border, and covered with coarse scales, each of which bears a thorny stump or spine. The radial shields are bare, large, triangular, longer than broad, and fully in contact with each other. Interbrachial spaces below are narrow, and are also covered with coarse scales bearing a thorny stump.

The oral shields are small, rhomboidal, producing a distal lobe, and thorny at the distal part. The adoral shields are very large, somewhat trapezoid in shape, broader within than without, closely appressed to each other, as well as to the oral shield, and furnished with one or two stumps on the surface. The oral plates are inconspicuous. The oral papillae are seven or eight in number on a side and elongate; the outer ones are crowded, and slightly enlarged and rough at the end, while the inner ones are conical. The teeth are also elongate.

The arms are broken, but rather stout. The dorsal arm plates are triangular or rhomboidal, broader than long, thorny at the distal part, and not in contact with each other. The ventral arm plates are large, rhomboidal, much broader than long, and separated from each other. At first they are smooth, but becoming rough by the spinules localized at the aboral part. The side arm plates are well developed, meeting above and below, and very prominent along the distal ridge which supports the arm spines. The arm spines are eight or nine in number near the disk and strongly serrated; the upper ones are very long, almost about three times as long as a joint, but they become smaller ventrad, the undermost one being the smallest and less than a joint in length. The tentacle scales small and very thorny; there are three such scales to each proximal pore, but reduced to one distally. The colour of the specimen dried from alcohol is dirty white.

Family Hemieuryalidae

18. *Ophiomæris pentagona* sp. nov.

(Text-fig. 13)

Disk 4 mm in diameter; arms about 10 mm long; breadth of arm 1.5 mm at base.

Disk somewhat decagonal, notched at the interradial border, elevated along the radial line, but sunken at the interradial area. It is covered with twenty-one large plates, between which a number of small scales are intervening. Central plate of moderate size, pentagonal. Radial plates also pentagonal, with an angle turning proximad. These plates are larger than the former, separated from each other, as well as from the central plate, by elongate or oval scales. Radial shields very large, triangular, with a rounded abradial angle. They are separated from each other within by two large plates, one of which is the radial plate, while the other is a triangular plate just distal to the former. A number of distinct conical granules are borne on the margin of radial and its abcentral plates, and between the radial shields. Genital slits very indistinct.

Oral shields rhomboidal when viewed from below, but in reality the distal angle protrudes upwards as a tongue-like lobe. Adoral shields very large, somewhat semicircular in shape, proximal border straight, distal one rounded, fully in contact with each other on the interradial line. Oral plates small, high. Oral papillae three or four on a side of an oral angle; the outermost one is broad and rounded along the free margin, while the inner ones are narrow and pointed at the end. Teeth five in number

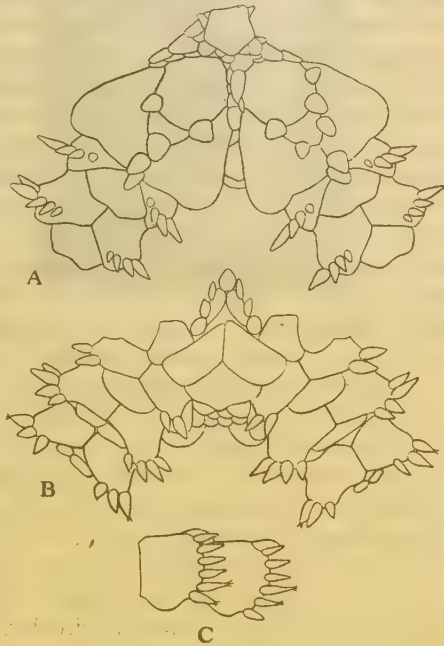


Fig. 13. *Ophiomæris pentagona*.

A. From above. B. From below.

C. Side view of two arm joints near disk. $\times 15$.

on a jaw, of which the undermost one is pentagonal, longer than broad, and blunt at the tip, while the others are flat and spatulate.

Arms knobbed, stout at the base, gradually tapering distally, coiled vertically. Dorsal arm plates rather small, somewhat pentagonal, with an obtuse proximal angle, distal margin slightly notched at the middle, broader than long; they are well separated from each other by the side arm plate. First ventral arm plates moderate, pentagonal, with a proximal angle, much longer than wide, broader within than without. Second one nearly as large as the former, much broader than long, with a broad proximal angle and a convex distal margin. Following ones reduced in size abruptly and broken into fragments, finally becoming rudimentary. Side arm plates well developed, prominent along the distal edge, broadly in contact with each other both above and below. Arm spines six or seven in number, but falling to four distally. They are less than one half of a joint in length; upper ones somewhat slender, while the under ones robust. Two or three arm spines from below are thorny at the tip. Tentacle scales wanting.

Colour (dried from alcohol), white.

Locality.—Off Ogasawara, 1940; three specimens.

The new species is very near to *O. projecta* MATSUMOTO, especially in having granules on the dorsal side of disk, but differs from it in the scaling of disk. In *O. projecta*, the radial shields are separated from each other at the proximal part by one radial plate, but in *O. pentagona*, another large plate is intervening between the radial plate and radial shields. Further, the dorso-central plate of the former is circular, while it is pentagonal in the latter; the species is named after the shape of that plate.

Family Ophiotrichidae

19. *Ophiotrix vetusta* K  HLER

(Text-fig. 14)

K  HLER, 1930, p. 177, pl. X, figs. 5-7.

Localities.—Off Ogasawara, 1940; one specimen. Off Ya  yama, 1940; three specimens.

Distribution.—Kei Islands.

The present specimens measure from 9 to 14 mm across the disk. The radial shields are comparatively longer than those of the type, but the other characters agree well with those of the latter.



Fig. 14. *Ophiothrix vetusta*;
from above. $\times 1.5$.

Family Ophiolepididae

20. *Ophiomusium simplex* LYMAN

Ophiomusium simplex: LYMAN, 1878, p. 115, pl. I, figs. 10-11. CLARK, 1915, p. 333.

KEHLER, 1922, p. 417, pl. LXXXVIII, figs. 10-11.

Ophiomusium sanctum: KEHLER, 1904, p. 59, pl. XI, figs. 7-9.

Locality.—Off Ogasawara, 1940; four specimens.

Distribution.—Eastern Sea. Southwest of the Gotō Islands. Malaysian Waters. Amboina. Kei Islands.

Our specimens are almost of uniform size, measuring about 13 mm across the disk. The arrangement of disk plates in two specimens is like that of the *simplex*-type, while in the other two it is similar to that of the *sanctum*-type. But the arrangement of plates on the ventral side of disk is in accord with that of the *simplex*-type in all the specimens.

Family Ophiodermatidae

21. *Pectinura aequalis* (LYMAN)

Ophiopeza aequalis: LYMAN, 1882, p. 12, pl. XXVII, figs. 7-9.

Pectinura aequalis: CLARK, 1909b, p. 118.—1915, p. 303. KEHLER, 1922, p. 337, pl. LXXVII, figs. 16-17.

Locality.—Off Yaéyama, 1940; two specimens.

Distribution.—Philippine Islands. Kei Islands. New Guinea.

Family Ophiochitonidae

22. *Ophioplax lamellosa* MATSUMOTO

MATSUMOTO, 1915, p. 88.—1917, p. 330, fig. 92, pl. VI, fig. 9.

Locality.—Off Ogasawara, 1940; one specimen.

Distribution.—Off Kōzu-sima, Sagami Sea.

The present species has been known only by a single specimen, and it is worthy of special notice that we have the second specimen of this rare species in the collection. As the specimen at hand is well in accord with MATSUMOTO's original description and figures, any further comment of this species appears to be unnecessary.

(*Amakusa Marine Biological Laboratory, Kumamoto-ken*)

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NOTE ON THE OPHIURANS OF AMAKUSA, KYŪSYŪ¹⁾

Shiro MURAKAMI

As the Ophiurans of Amakusa, so far as I know, have been studied very unsatisfactorily, and a good deal of specimens have come to my hand from time to time, I think it worth while to report the result of my study on them in the present paper. The greater part of material described here was obtained by myself at Tomioka, where I am residing since 1940, as a member of the Amakusa Marine Biological Laboratory of Kyūsyū Imperial University. Some of them were found living on the shore around the Peninsula Tomioka, while the others were caught in a fishing net called "kasi-ami", used particularly for capturing the Nipponese spiny lobster (*Panulirus japonicus*) off the peninsula where the water is from some fifteen to forty meters deep. In addition to these, a number of specimens have been preserved at the said laboratory, being collected at Tomioka and its vicinities by Professor Dr. H. OHSHIMA and the other gentlemen. A close examination of these Ophiurans reveals no less than thirty-two species, among which three species are regarded to be new to science, and one belonging to a new genus. The whole species contained in the present paper are listed as follows:

Order Phrynophiurida

Family Trichasteridae

1. *Astroceras annulatum* MORTENSEN
2. *Trichaster elegans* LUDWIG

Family Gorgonocephalidae

¹⁾ Contributions from the Zoological Laboratory, Kyūsyū Imperial University, No. 169; Papers from the Amakusa Marine Biological Laboratory, No. 91.

3. *Astrocladus coniferus* (DÖDERLEIN)
4. *Astroboa arctos* MATSUMOTO
5. *Astroglymma sculptum* (DÖDERLEIN)

Order Gnathophiurida

Family Amphiuridae

6. *Ophiactis modesta* BROCK
7. *Ophiactis savignyi* (MÜLLER et TROSCHER)
8. *Ophiophragmus japonicus* MATSUMOTO
9. *Amphipholis japonica* MATSUMOTO
10. *Amphipholis kochii* LÜTKEN
11. *Amphiura æstuarii* MATSUMOTO
12. *Amphiura euopla* CLARK
13. *Amphiura lütkeni* DUNCAN
14. *Amphiura pachybactra* MURAKAMI
15. *Amphiura syntaracha* CLARK

Family Ophiotrichidae

16. *Ophiothrix koreana* DUNCAN
17. *Ophiothrix marenzelleri* KÖHLER
18. *Ophiothrix stabilis* KÖHLER
19. *Ophiotrichoides nereidina* (LAMARCK)
20. *Ophiogymna elegans* LJUNGMAN
21. *Ophiomaza cacaotica* LYMAN
22. *Ophiomaza kanekoi* MATSUMOTO
23. *Ophiothela danæ* VERRILL

Order Chilophiurida

Family Ophiolepididae

24. *Ophiura kinbergi* (LJUNGMAN)
25. *Ophioplocus japonicus* CLARK

Family Ophiodermatidae

26. *Ophiarachnella differens* sp. nov.
27. *Ophiarachnella gorgonia* (MÜLLER et TROSCHER)
28. *Ophiostegastus instratus* gen. et sp. nov.

Family Ophiochitonidae

29. *Ophionereis porrecta* LYMAN
30. *Ohiocrasis latens* sp. nov.
31. *Ophiocrasis marktanneri* MATSUMOTO

Family Ophiocomidae

32. *Ophiomastix mixta* LÜTKEN

Among these Ophiurans, *Ophiactis savignyi* is an intertropical species, reaching as far as Misaki northwards. *Trichaster elegans*, *Astrocladus coniferus*, *Astroglymma sculptum*, *Ophiactis modesta*, *Amphiura lütkeni*, *Ophiothrix koreana*, *Ophiotrichoides nereidina*, *Ophiogymna elegans*, *Ophiomaza cacaotica*, *Ophiothela danæ*, *Ophiura kinbergi*, *Ophiarachnella gorgonia*, *Ophionereis porrecta* and *Ophiomastix mixta* are Indo-Pacific in their distribution. Both these intertropical and Indo-Pacific species are referable to the tropical elements. *Astroceras annulatum*, *Astroboa arctos*, *Amphipholis japonica*, *Amphipholis kochii*, *Amphiura æstuarii*, *Amphiura euopla*, *Amphiura pachyactra*, *Amphiura syntaracha*, *Ophiothrix marenzelleri*, *Ophiothrix stabilis*, *Ophiomaza kanekoi*, *Ophiarachnella differens*, *Ophiostegastus instratus*, *Ophiocrasis latens* and *Ophiocrasis marktanneri* have been known only from vicinities of Honsyū, and are thought to represent the Honsyū species. *Ophiophragmus japonicus* and *Ophioplocus japonicus* had been also considered to belong to Honsyū species, but recently the former was reported from the Gulf of Thai (Siam) and Amboina by KÖHLER (1930), and the latter from Hong Kong by MORTENSEN (1934). At any rate, the Ophiuran fauna of Amakusa is deemed to be constituted mainly of tropical and Honsyū elements.

I must here express my hearty gratitude to Professor Dr. H. OHSHIMA for his kind guidance given to me during the investigation, and for giving me the opportunity of studying the valuable material preserved in the Amakusa Marine Biological Laboratory. I wish also to tender my thanks to my colleague, Mr. T. KAWAHARA for his kind assistance in taking a photograph for illustration.

SYSTEMATICS

Order Phrynophiurida

Family Trichasteridae

1. *Astroceras annulatum* MORTENSEN

Astroceras pergamena: MATSUMOTO, 1917, p. 35, fig. 7, b.

Astroceras annulatum: MORTENSEN, 1933, p. 47, figs. 32 & 33, b, pl. V, figs. 20-25.

Localities.—Tomioka, Aug. 23, 1942; eight specimens (caught in "kasi-ami"). Same locality; five specimens.

Distribution.—Sagami Sea. Near the Gotō Islands.

The present species is a small six-armed Ophiuran, found clinging to a colony of *Melitodes* sp. The colour in life is yellowish white on the disk and light pinkish on the arms. At first CLARK and MATSUMOTO described it as a young form of *A. pergamena*, but later it was separated from *A. pergamena* by MORTENSEN as a distinct species.

2. *Trichaster elegans* LUDWIG

LUDWIG, 1878, p. 213, pl. V, figs. 1-9. MATSUMOTO, 1917, p. 38, fig. 8, pl. II, figs. 7-8.

Localities.—Tomioka, Nov. 1, 1940; one specimen (caught in "kasi-ami"). Same locality; four specimens.

Distribution.—Tanabe Bay. Pacific Ocean. India.

This is an elegant Ophiuran coloured yellowish gray on the dorsal side of disk and arms, and is occasionally caught in "kasi-ami" at Tomioka.

Family Gorgonocephalidae

3. *Astrocladus coniferus* (DÖDERLEIN)

Astrophyton pardalis: DÖDERLEIN, 1902, p. 323.

Astrophyton coniferum: DÖDERLEIN, ditto, p. 325.

Astrocladus dofleini: DÖDERLEIN, 1910, p. 256.¹⁾

Astrocladus coniferus: DÖDERLEIN, 1911, p. 46 & 75, pl. II, figs. 7-7a, pl. IV, figs. 1-3a, pl. VII, figs. 5-6a & 16. MATSUMOTO, 1917, p. 77, fig. 23.

Localities.—Uze, Tomioka, June 1928; one specimen (probably caught in "kasi-ami"). Sakasegawa, April 8, 1932; one specimen. Tomioka, Jan. 4, 1942; one specimen (caught in "kasi-ami").

Distribution.—Misaki. Sagami Sea. Suruga Gulf. Off Omae Zaki. Kagosima. Colnett Strait. Eastern Sea. Fusan, Tyōsen. Wladiwostok. Indian Ocean.

4. *Astroboa arctos* MATSUMOTO

(Plate I, figs. 2-3)

MATSUMOTO, 1915, p. 57.—1917, p. 80, fig. 24.

Localities.—Tomioka; five specimens (caught in "kasi-ami"). Unzen Zaki, Tomioka, June 4, 1928; two specimens.

Distribution.—Misaki.

Though the colour of our specimens is purplish black above in life like that of *A. nigra* DÖDERLEIN, it becomes dark grayish

¹⁾ "Schultze-Zool. Ergebn., IV", not accessible to me.

brown above and dark yellowish brown below in alcohol, as described by MATSUMOTO. Further, resembling the type of *A. arctos*, the double rows of hook-bearing granules are limited to the terminal part of arm, the stout proximal part of arm being free from them. This Ophiuran is often found among the catch of "kasi-ami".

5. *Astroglymma sculptum* (DÖDERLEIN)

(Text-fig. 1; Plate I, fig. 1)

Astrophyton sculptum: DÖDERLEIN, 1896, p. 299, pl. XVIII, figs. 29-29b.

Astrodactylus sculptus: DÖDERLEIN, 1911, p. 56, fig. 13, a-b.

Astroglymma sculptum: DÖDERLEIN, 1927, p. 47 & 96, pl. I, figs. 3-4, pl. V, fig. 13.¹⁾
MORTENSEN, 1934, p. 5, pl. VI.

Localities.—Siroiwa Zaki, Tomioka, Aug. 21, 1931; one specimen (probably caught in "kasi-ami"). Tomioka; three specimens (caught in "kasi-ami").

Distribution.—Hong Kong. Amboina. Kei Islands.

The largest specimen before me is 55 mm in diameter of disk. The colour in life is deep red, while in alcohol, it fades to dirty gray or red, with a number of dirty purplish speckles on the dorsal side of disk. That the madreporites are five in number, one on each interradius, that the ventral arm plates are wanting,

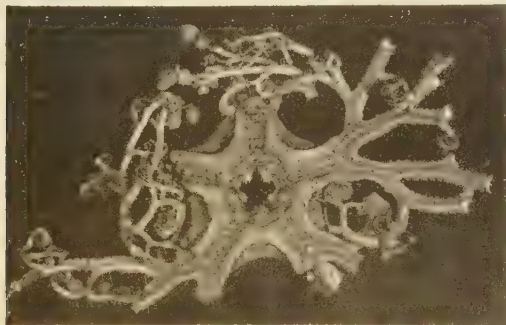


Fig. 1. *Astroglymma sculptum*; from below. $\times \frac{1}{4}$.

and that the hook-spines have only one branch on a side, are remarkable characters of this species. Though the present species

¹⁾ "Abhandl. Bayer. Akad. Wiss., XXXI, 6", not accessible to me.

has not so far been reported from Nippon, it is common at Tomioka, usually found among the catch of "kasi-ami".

Order Gnathophiurida

Family Amphiuridae

6. *Ophiactis modesta* BROCK

BROCK, 1888, p. 482. MATSUMOTO, 1917, p. 156, fig. 38.

Localities.—Tomoé Zaki, Tomioka, Aug. 14, 1931; numerous specimens. Tomioka, May 5, 1940; four specimens (caught in "kasi-ami"). Same locality, Aug. 15, 1941; nine specimens. Same locality, April 24, 1942; two specimens. Same locality, Aug. 15, 1942; one specimen.

Distribution.—Misaki. Palao. Amboina. Thursday Island.

Those specimens dated Aug. 14, 1931 were found creeping out from a sponge, and show that they reproduce by schizogony, the body being asymmetrical without exception.

7. *Ophiactis savignyi* (MÜLLER et TROSCHER)

Ophiopsis savignyi: MÜLLER et TROSCHER, 1842, p. 95.

Ophiactis savignyi: LYMAN, 1882, p. 115. CLARK, 1915, p. 265. MATSUMOTO, 1917, p. 158, fig. 39.

Localities.—Near Kakize, Tomioka, May 5, 1940; six specimens. Tomioka, Aug. 15, 1941; two specimens (caught in "kasi-ami"). Ebisu Bana, Tomioka; three specimens.

Distribution.—Misaki. Izu. Tyōsen Seas. Malaysian Waters. Australia. Palao. Gulf of California. West Indies.

8. *Ophiophragmus japonicus* MATSUMOTO

MATSUMOTO, 1915, p. 70. CLARK, 1915, p. 239. MATSUMOTO, 1917, p. 183, fig. 48, pl. IV, fig. 3.

Localities.—Tomoé Bay, Tomioka, Aug. 14, 1929; three specimens. Tomioka Bay; three specimens.

Distribution.—Mutu Bay. Off Oginohama, Rikuzen. Enoura, Suruga. Mikawa Bay. Ise Bay. Matoya Bay. Ago Bay. Beppu Bay. Off Namami, Kagosima Gulf. Thai Bay. Amboina.

9. *Amphipholis japonica* MATSUMOTO

MATSUMOTO, 1915, p. 71. CLARK, 1915, p. 241. MATSUMOTO, 1917, p. 186, fig. 49.

Localities.—Siroiwa Zaki, Tomioka; numerous specimens. Near Kakize, Tomioka; numerous specimens.

Distribution.—Misaki. Izu. Tomo, Bingo. Asami Bay, Tusima. Simabarā, Hizen. Akune, Satuma.

A. japonica is abundant at Tomioka, especially at Siroiwa Zaki and near Kakize, living on the bottom of fine sand under a stone at the intertidal zone. It is a small viviparous Ophiuran, being pregnant all the year round.

10. *Amphipholis kochii* LÜTKEN

Amphipholis kochii: LÜTKEN, 1872, p. 10, pls. I-II, fig. 6. CLARK, 1915, p. 241. MATSUMOTO, 1917, p. 192, fig. 52, pl. IV, fig. 2.

Amphiura kochii: LYMAN, 1882, p. 146.

Localities.—Ebisu Bana, Tomioka, April 5, 1928; two specimens. Siki, April 6, 1931; one specimen. Ebisu Bana, Tomioka, May 29, 1942; numerous specimens.

Distribution.—Hakodate. Mutu Bay. Aomori Bay. Misaki. Izu. Wladiwostok.

11. *Amphiura æstuarii* MATSUMOTO

MATSUMOTO, 1915, p. 73.—1917, p. 208, fig. 57.

Locality.—Near the laboratory, Tomioka, April 13, 1941; five specimens.

Distribution.—Misaki. Matoya Bay. Ago Bay. Gokasyo Bay. Nanao Bay.

The present species is obviously related to *A. vadicola* MATSUMOTO, but is by no means misled to it, being distinguished by the larger radial shields, by the coarser scales around the radial shield, and by the well developed dorsal arm plates from the first proximal. At Tomioka, it is also found buried in mud near the laboratory; this mode of living is in accord with what MATSUMOTO already presumed.

12. *Amphiura euopla* CLARK

CLARK, 1911, p. 144, fig. 57. MATSUMOTO, 1917, p. 201, fig. 55.

Localities.—Kameura Bay, Simo Sima, May 1, 1934; seventeen specimens. Near the laboratory, Tomioka, April 13, 1941; two specimens.

Distribution.—Misaki. Enosima, Sagami. Suruga Gulf. Izu-hara, Tusima.

The specimens before me are somewhat different from the type described by CLARK, but agree well with MATSUMOTO's description and figures, though the ventral interbrachial spaces are not bare. They are rather small, measuring 3.5 to 5.5 mm across the disk.

13. *Amphiura lütkeni* DUNCAN

Amphiura lütkeni: DUNCAN, 1879, p. 464, pl. X, fig. 17. CLARK, 1915, p. 228. MATSUMOTO, 1917, p. 208.

Amphiura duncani: LYMAN, 1882, p. 143.

Localities.—Tomioka, Aug. 21, 1942; one specimen (caught in "kasi-ami"). Same locality, Aug. 22, 1942; two specimens.

Distribution.—Tyōsen Seas. Malaysian Waters.

This is a delicate, but handsome Ophiuran, the disk of which is easily broken when pulled out from the shelter. The ground colour in life is white, ornamented with red markings on the dorsal side of disk and arms. This species is met with very rarely.

14. *Amphiura pachyactra* MURAKAMI

MURAKAMI, 1942, p. 17, fig. 7.

Localities.—Ebisu Bana, Tomioka, May 29, 1942; five specimens. Same locality; four specimens.

Distribution.—Sitaru, Izu.

This species is one of the common Ophiurans at Tomioka, living under stones on the bottom of fine sand at the intertidal zone.

15. *Amphiura syntaracha* CLARK

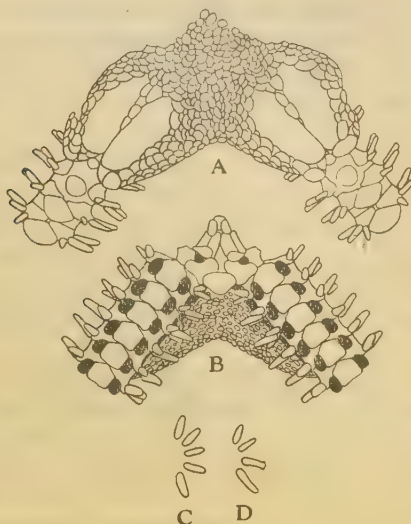
(Text-fig. 2)

CLARK, 1915, p. 232, pl. V, figs. 14-15.

Localities.—Siki, April 6, 1931; one specimen. Same locality; three specimens. Ebisu Bana, Tomioka; four specimens.

Distribution.—Mouth of the Gulf of Tokyo.

Fig. 2. *Amphiura syntaracha*.
 A. From above. B. From below.
 C. Arm spines of one side of an
 arm joint near disk.
 D. Arm spines of one side of an
 arm joint at some distance
 from disk. $\times 15$.



Family Ophiotrichidae

16. *Ophiothrix koreana* DUNCAN

DUNCAN, 1879, p. 473, pl. XI, figs. 28-32. CLARK, 1911, p. 257, figs. 127-128.—1915, p. 273.
 MATSUMOTO, 1917, p. 220, pl. IV, fig. 7.

Localities.—Tomoé Zaki, Tomioka, April 7, 1928; three specimens. Same locality, June 11, 1933; one specimen. Hutaé, Feb. 26, 1935; six specimens. Tomoé Zaki, Tomioka, April 30, 1940; one specimen. Tomioka, May 5, 1940; one specimen (caught in "kasi-ami"). Same locality, Aug. 15, 1941; three specimens. Same locality; thirty-five specimens. Ebisu Bana, Tomioka; two specimens.

Distribution.—Hakodate. Gulf of Tokyo. Uruga Channel. Sagami Sea. Suruga Gulf. Sea of Nippon. Nanao Bay. Tyōsen Strait. Eastern Sea. Southwest of the Gotō Islands. Kagosima Gulf. Off Satuma. Philippine Islands. Moluccas. Banda. Amboina. Kei Islands.

17. *Ophiothrix marenzelleri* KÖHLER

KÖHLER, 1904, p. 103, figs. 76-78. MATSUMOTO, 1917, p. 220.—1941, p. 342, fig. 8.

Locality.—Tomoé Zaki, Tomioka, April 7, 1928; six specimens.

Distribution.—Mutu Bay. Misaki. Entrance to the Gulf of Tokyo. Off Zyōgasima, Sagami Sea. Enosima. Off Ayukawa. Kominato. Toba, Sima. Matoya Bay. Tomo, Bingo. Asami Bay, Tushima. Kagosima Gulf.

18. *Ophiothrix stabilis* KÆHLER

KÆHLER, 1904, p. 84, figs. 46–49. MATSUMOTO, 1917, p. 224.

Localities.—Tomoé Zaki, Tomioka, April 7, 1928; two specimens. Same locality, June 11, 1933; six specimens. Same locality, Feb. 27, 1935; six specimens. Same locality, April 30, 1940; two specimens. Tomioka; five specimens (caught in “kasi-ami”).

Distribution.—Misaki. Kōbe.

In our specimens, the dorsal arm plates are rough or thorny on the surface, especially at the distal part of them, though this feature was not noticed by KÆHLER and MATSUMOTO. But the other characters are quite in accord with those of the type.

19. *Ophiotrichoides nereidina* (LAMARCK)

Ophiura nereidina: LAMARCK, 1816, p. 544.

Ophiothrix nereidina: MÜLLER et TROSCHEL, 1842, p. 115. CLARK, 1915, p. 275. MATSUMOTO, 1917, p. 224, fig. 61, pl. IV, fig. 6.

Ophiotrichoides nereidina: CLARK, 1938, p. 306.

Locality.—Kakize, Tomioka, Aug. 4, 1929; one specimen.

Distribution.—Misaki. Simoda, Izu. Okinawa. Yaéyama. Indo-Pacific.

20. *Ophiogymna elegans* LJUNGMAN

CLARK, 1915, p. 286, pl. XII, figs. 7–8. KÆHLER, 1922, p. 281, pl. XLIII, figs. 3–8, pl. CIII, fig. 7. MURAKAMI, 1942, p. 20.

Localities.—Tomioka, May 5, 1940; one specimen (caught in “kasi-ami”). Same locality; fourteen specimens.

Distribution.—Izu. Syōnan (Singapore). Hong Kong. Philippine Islands. Sulu Archipelago. Gulf of Davao.

21. *Ophiomaza cacaotica* LYMAN

LYMAN, 1871, p. 9, pl. I, fig. 15. DÜDERLEIN, 1896, p. 298, pl. XVII, figs. 26–26a. CLARK, 1915, p. 283. KÆHLER, 1922, p. 299.

Locality.—Tomioka, Aug. 24, 1942; two specimens (caught in “kasi-ami”).

Distribution.—Zanzibar. Trincomalee. Mergui Archipelago. Syōnan. Sunda Islands. Java. Sea of Nippon. Hong Kong. China Sea. Sulu Archipelago. Kei Islands. Torres Strait. Thursday Island. East coast of Australia. New Caledonia.

The specimens before me are very elegant; the disk is streaked radially with white and purplish brown, and the arms are ornamented with a broad white longitudinal stripe hemmed by purplish brown. They were found tightly clinging to a crinoid caught in "kasi-ami".

22. *Ophiomiza kanekoi* MATSUMOTO

MATSUMOTO, 1917, p. 227, fig. 66.

Localities.—Tomoé Zaki, Tomioka, Sept. 20, 1930; eight specimens. Tomioka; two specimens (caught in "kasi-ami").

Distribution.—Simabara, Hizen.

This Ophiuran is common at Tomioka, occurring always closely adhering to a crinoid, which lives outside of Tomoé Zaki where the water is several meters deep. The colour in life is entirely blackish purple.

23. *Ophiothela danæ* VERRILL

Ophiothela danæ: VERRILL, 1869, p. 391. MATSUMOTO, 1917, p. 230, fig. 67, pl. IV, fig. 8.

Ophiothela isidicola: LÜTKEN, 1872, p. 92, pls. I-II, figs. 4a-4g.

Ophiothela verrilli: DUNCAN, 1879, p. 477, pl. XI, fig. 33.

Ophiothela danæ var. *involuta*: KÖHLER, 1898, p. 88.

Localities.—Tomioka, April 23, 1942; six specimens (caught in "kasi-ami"). Same locality; four specimens.

Distribution.—Misaki. Izu. Tyōsen Seas. Strait of Taiwan (Formosa). Indo-Pacific.

Order Chilophiurida

Family Ophiolepididae

24. *Ophiura kinbergi* (LJUNGMAN)

Ophioglypha kinbergi: LJUNGMAN, 1866, p. 116.¹⁾

Ophioglypha sinensis: LYMAN, 1871, p. 12, pl. I, figs. 1-2.

Ophioglypha ferruginea: LYMAN, 1878, p. 68, pl. III, fig. 76.

Ophiura kinbergi: CLARK, 1911, p. 37, fig. 9.—1915, p. 321. MATSUMOTO, 1917, p. 271, fig. 73.

¹⁾ "Öfv. K. Vet. Akad. Föhr., XXVII", not accessible to me.

Locality.—Tomioka Bay; three specimens.

Distribution.—Off Yokohama. Uruga Channel. Misaki. Mikawa Bay. Ise Bay. Matoya Bay. Inland Sea. Tomo, Bingo. Beppu Bay. Hakata Bay. Tusima. Eastern Sea. Off Etigo, Sea of Nippon. Indo-Pacific.

25. *Ophioplocus japonicus* CLARK

CLARK, 1911, p. 30, fig. 5.—1915, p. 344. MATSUMOTO, 1917, p. 302, fig. 84, pl. V, fig. 11.

Locality.—Tomioka; three specimens.

Distribution.—Entrance of the Gulf of Tokyo. Misaki. Enosima. Odawara. Bōsyū. Suruga. Izu. Ayukawa. Hong Kong.

The present species occurs abundantly around Tomioka, generally living under stones near the low-tide mark. This is one of the most common Ophiurans along the entire southern coast of Honsyū and its vicinities. The distribution extends southwards, reaching as far as Hong Kong, as reported by MORTENSEN.

26. *Ophiarachnella differens* sp. nov.¹⁾

(Text-fig. 3)

Disk 11 mm in diameter; arms varying in length, but the longest available 35 mm long. Breadth of arm 2.5 mm at base.

Disk convex above, pentagonal, covered with fine, more or less spaced granules, but the radial shields, trio of plates at the base of arm, a plate at the middle of each interradial border and a number of scales near the periphery are entirely bare. Radial shields rather small, somewhat elliptical, longer than broad, well separated from each other. Central plate of trio somewhat smaller than the radial shield, rounded; other two small, rounded triangular. Interbrachial spaces below also covered with fine granules, but the several scales are free from them. Genital slits large, as long as three arm joints.

Oral shields naked, moderate in size, roughly triangular in shape, with angles quite blunt and margins somewhat concave. Supplementary oral shields also bare, small, semicircular, close to the oral shield. Adoral shields small, at sides of oral shield, gran-

¹ *Differens*, signifying *different*, in reference to the disk covering different from that of the allied species.

ulated at the distal part. Oral plates concealed by a granulation. Oral papillae eight or nine on a side of an oral angle; the proximal ones subequal, thick, but blunt at the tip, while the outer ones flat, broad, truncated at the end, but the distalmost one is terminating to a point upwards so as to overlap the following two. Two infra-dental papillae present at the tip of one oral angle.

Dorsal arm plates thick and stout. At first they are tetragonal, the distal border being convex and the lateral sides diverging without. The proximal border of dorsal arm plate becomes shorter and shorter as it goes distally, and finally disappears so as to make the plate triangular. They are in contact with each other till near the tip of arm. First ventral arm plates rather large, broader

than long, distal border convex, proximal one making a narrow angle turning to the mouth slit. Following ones heptagonal with a distal angle very rounded, broader than long, but becoming pentagonal and longer than broad distally. They are well in contact with each other at the proximal half of arm. No pores between basal ventral arm plates. Side arm plates thick and stout, as high as arm joint, but not meeting either above or below; each one carries nine stout, conical, subequal arm spines, which are less than one half of joint in length and are reduced in number to eight, seven, six distally and finally to three at the tip of arm. Tentacle scales two to each pore at the proximal two-thirds of arm; adradial one larger than the abradial one which is overlapping the base of undermost arm spine. Farther out they fall to one to each pore.

Colour in life, dirty gray, with dark spots on the disk; some

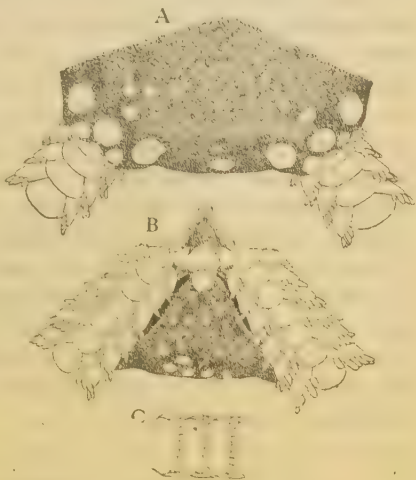


Fig. 3. *Ophiarachnella differens*.

- A. From above. B. From below.
C. Side view of three arm joints near disk. $\times 5$.

scales near the periphery white with rusty shade at the centre. Arms banded with rust; the dorsal arm plates, some of which have three white speckles on the outer margin, are darker than the side arm plates so as to make a broad longitudinal stripe. Ventral side of disk whitish; that of the terminal part of arm yellowish gray. Arm spines yellowish gray distally and whitish towards base.

Locality.—Tomoé Zaki, Tomioka, Aug. 15, 1943; one specimen.

This Ophiuran represented by a single individual in the collection, was found living under a stone on the sandy bottom, but the characters are so remarkable that it well deserves to stand as a distinct species. It is closely allied to *O. infernalis* (MÜLLER et TROSCHER), *O. similis* (KÖHLER) and *O. megalaspis* CLARK, but it is easily distinguished from *O. infernalis* by the coarser and more spaced granulation of disk, and by the thicker and stouter arm plates, from *O. similis* by having more numerous bared scales on the disk, and from *O. megalaspis* by the smaller and more broadly separated radial shields.

27. *Ophiarachnella gorgonia* (MÜLLER et TROSCHER)

Ophiarachna gorgonia: MÜLLER et TROSCHER, 1842, p. 105.

Pectinura gorgonia: LÜTKEN, 1869, p. 33.

Ophiarachnella gorgonia: CLARK, 1909, p. 123.—1915, p. 305. MATSUMOTO, 1917, p. 323, pl. VI, fig. 7.

Locality.—Tomoé Zaki, Tomioka, June 29, 1930; two specimens.

Distribution.—Misaki. Suruga. Izu. Kagosima Gulf. Yaéyama. Indo-Pacific.

At first glimpse, this animal is liable to be mistaken for *Ophioplocus japonicus* occurring together with it, but the coloration of *O. gorgonia* is clearer than that of *O. japonicus*. Further, they are quite different in the other characters.

Ophiostegastus gen. nov.¹⁾

Disk closely covered with granules both above and below. Radial shields invisible. Oral papillae numerous. Arms more or less covered with a fine granulation. Arm plates well developed.

¹⁾ "Οφίς, signifying snake, and στεγαστος, signifying covered, in reference to the disk and arms covered with granules.

Arm spines short and thick. Tentacle scales two to each pore. Genital slits also two in each interradius.

Type species; *Ophiostegastus instratus*.

The new genus is obviously related to *Pectinura*, *Ophiopezella*, *Ophiochæta*, *Ophiarachnella* and *Ophiochasma* in having short arm spines, two tentacle scales to each pore, and two genital slits in each interradius, but the granulation of arms makes a remarkable character to distinguish it from the above enumerated genera. Besides the genotype, it contains *Ophiocryptus pacificus* MURAKAMI, which at first I thought belonging to *Ophiocryptus*, but it must be strictly removed from the said genus for the reason of having two, not four, genital slits in each interradius.

28. *Ophiostegastus instratus* sp. nov.¹⁾

(Text-fig. 4)

Ophiarachnella infernalis: MATSUMOTO, 1917, p. 324, fig. 90. (Non MÜLLER et TROSCHEL, 1842.)

Disk 7 mm in diameter; arms 21 mm long. Disk pentagonal, flat, closely covered with fine granules except the trio of plates at base of arm and a single marginal scale at the middle of each interradial border, which are more or less bare. Radial shields invisible. Interbranchial spaces below, adoral shields and oral plates also covered with a close granulation. Oral shields naked, triangular in shape, with angles rounded, about as wide as long. Supplementary oral shields present distal to the oral shield, smaller than the latter, half-moon shaped, more or less covered with granules. Oral papillae nine or ten on a side, subequal, blunt at the tip, but the outermost one is largest and pointed at the tip, overlapping the following two. Genital slits rather small, two and a half times as long as a joint.

Arms also granulated, especially the side arm plates so. The dorsal and ventral arm plates are mostly naked, but becoming completely covered with granules very near the tip of arm. Dorsal arm plates convex, tetragonal, as wide as long, distal border markedly rounded and very much longer than the proximal one, but becoming triangular in shape at the terminal part of arm. Those of the proximal half of arm are in contact with each other, but become separated from each other distally. First ventral arm

¹⁾ *Instratus*, signifying *uncovered*, in reference to the bared oral shields.

plates rather large, about as broad as long, very rounded, with a proximal lobe. Succeeding two hexagonal and slightly broader than long, but becoming octagonal or heptagonal and longer than broad distally. They are in contact with each other except those near

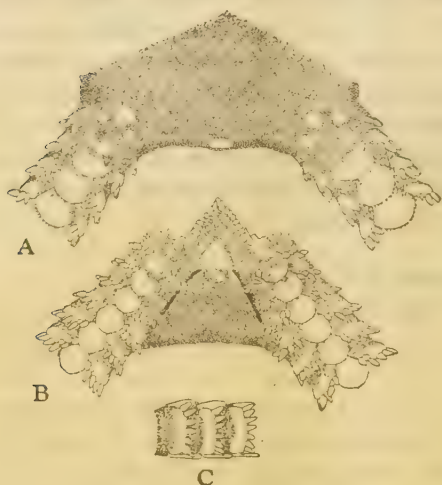


Fig. 4. *Ophiostegastus instratus*.

A. From above. B. From below.

C. Side view of three arm joints near disk. $\times 7$.

the tip of arm. Side arm plates broad and somewhat prominent, markedly granulated at the proximal two-thirds of plate, not meeting both above and below except the distal part of arm, each of which carries seven thick, conical, subequal arm spines near the disk, which are about one-third of a joint in length and are reduced to four in number near the end of arm. Tentacle scales two to each pore, small; the inner one slightly larger than the outer one, which is overlapping the base of undermost arm spine.

Colour in life; buffy citrine above, with black spots and short irregular lines on the disk; arms are ornamented with a dark longitudinal stripe and rust bands. Ventral side whitish.

Locality.—Siroiwa Zaki, Tomioka, July 16, 1943; one specimen.

The Ophiuran described and figured by MATSUMOTO as a variety of *Ophiarachnella infernalis* in 1917 is undoubtedly conspecific with the present species. It is easy to distinguish it from the other member of this genus, *O. pacificus* (MURAKAMI), by a different mode of granulation of disk. The oral shields, trio of plates at base of arm and a single marginal plate at each interradian border are more or less bare in *O. instratus*, while in *O. pacificus*, they are completely concealed by granules.

Family Ophiochitonidae

29. *Ophionereis porrecta* LYMAN

LYMAN, 1860, p. 260. CLARK, 1915, p. 289. MATSUMOTO, 1917, p. 334, fig. 93.

Localities.—Tomioka, Sept. 3, 1941; four specimens (caught in "kasi-ami"). Same locality; one specimen.

Distribution.—Izu. Tyōsen Strait. Okinawa. Andaman. Torres Strait. Fiji Islands. Honolulu.

30. *Ophiocrasis latens* sp. nov.¹⁾

(Text-fig. 5)*

Disk 5 mm in diameter; arms 27 mm long. Breadth of arm 1 mm at base. Disk rounded pentagonal, covered with a coating of fine, delicate scales. Radial shields small, triangular, more than three times as long as broad, well separated. Interbrachial spaces below also covered with a fine scaling. Genital slits very conspicuous.

Oral shields of moderate size, rhomboidal, proximal borders longer than distal ones, with angles rounded. Adoral shields small,

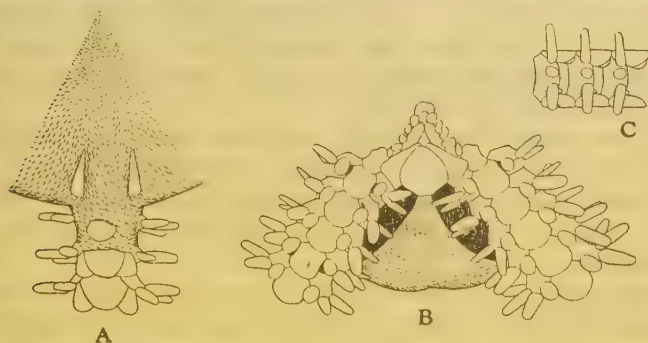


Fig. 5. *Ophiocrasis latens*.

A. From above. B. From below.

C. Side view of three arm joints near disk. $\times 10$.

longer than broad, narrow within, enlarged distally, not meeting on the interradial line. Oral plates also small, higher than broad.

¹⁾ *Latens*, signifying *hidden*, in reference to the rudimentary secondary supplementary dorsal arm plates being not visible from above.

Oral papillae five in number on a side; the proximal one thick and rounded; following three rather flat, blunt at the tip; the distalmost one conical, pointed at the tip. Teeth four or five on a jaw, squarish, thick; the undermost one is the smallest and less than one half of the following in size.

Arms somewhat narrow at base, broadest at some distance from the disk, beyond gradually tapering. First dorsal arm plates small, oval, separated from the second; following ones triangular, with a very rounded distal angle, wider than long, but becoming hexagonal and also somewhat broader than long at the middle of arm; beyond them they are again triangular in shape, with an angle turning proximad, and about as wide as long. They are well in contact with each other till near the tip of arm. Supplementary dorsal arm plates small, somewhat triangular in shape, with a rounded distal margin. Secondary ones, one on each side, rudimentary, not visible from above. First ventral arm plates small, pentagonal, longer than broad. Following ones tetragonal, with angles rounded and lateral sides concave, about as long as broad, but becoming pentagonal and longer than broad at the terminal part of arm; they are in contact with each other except those at the tip of arm. Side arm plates not meeting either above or below, carrying three flat, subequal, blunt arm spines, which are about as long as a joint in length. Tentacle scales single to each pore, large, flat, elliptical.

Colour (dried from alcohol); disk olive buff, reticulated with sepia; arms gray, banded with sepia; ventral side whitish.

Localities.—Tūzi Zima, April 23, 1940; one specimen. Siroiwa Zaki, Tomioka, Aug. 2, 1943; one specimen (collected by Mr. KAWAHARA).

The new species is allied to *O. dictydisca* CLARK in several features, but differs from it in the less developed secondary supplementary dorsal arm plates and in the rhomboidal oral shields. It is also distinguished from *O. marktanneri* MATSUMOTO by the shape of dorsal arm plates, by the less developed secondary pieces, by the more distinct radial shields, and by the more stout arm spines. This Ophiuran is generally found living under a stone at the intertidal zone.

31. *Ophiocrasis marktanneri* MATSUMOTO

MATSUMOTO, 1915, p. 90.—1917, p. 338, fig. 94, pl. VII, fig. 3.

Localities.—Siroiwa Zaki, Tomioka, April 22, 1940; one specimen.
Ebisu Bana, Tomioka, May 29, 1942; one specimen.

Distribution.—Misaki. Sagami. Izu.

Family Ophiocomidae

32. *Ophiomastix mixta* LÜTKEN

LÜTKEN, 1869, p. 44. CLARK, 1911, p. 256, fig. 126.—1915, p. 296. MATSUMOTO, 1917, p. 348, fig. 97.

Localities.—Ebisu Bana, Tomioka, Aug. 6, 1929; one specimen.
Tomoé Zaki, Tomioka, Aug. 14, 1931; three specimens. Siroiwa Zaki, Tomioka, March 7, 1939; one specimen.

Distribution.—Misaki. Enosima. Izu. Yaéyama. Indo-Pacific.

This is a beautiful Ophiuran, coloured deep red, the arms being banded with yellowish white on the terminal part. It is also found commonly at Tomioka near the low-tide mark, and is easily misled to *Ophiocoma* in the preserved state, but is different from it in that the granules of disk become elongated near the periphery.

(Amakusa Marine Biological Laboratory, Kumamoto-ken)

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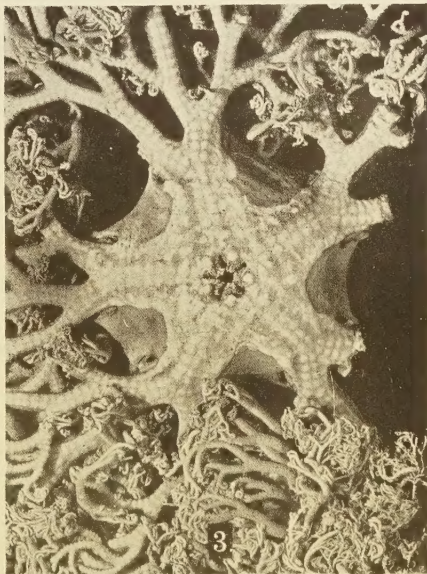
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EXPLANATION OF PLATE I

Fig. 1. *Astroglymma sculptum* (DIDERLEIN); from above, $\times \frac{1}{2}$.

Fig. 2. *Astroboa arctos* MATSUMOTO; from above, $\times \frac{2}{3}$.

Fig. 3. Same specimen; from below, $\times \frac{2}{3}$.



九州帝國大學農學部紀要
第7卷, 第7, 8冊

昭和十九年六月十日印刷
昭和十九年六月十五日發行

編纂兼
發行者 九州帝國大學

九州帝國大學內

印刷者 笹生亨二

印刷所 九州帝國大學印刷所

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